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1. An electrochemical converter power system, comprising

an array of electrochemical converters for generating power, said array adapted for receiving input reactants,

a pressure vessel disposed about said array of electrochemical converters, said pressure vessel collecting exhaust gases generated by said electrochemical converters when said converters are operating, and

means for exhausting said collected exhaust gases from said pressure vessel for use external thereto.

2. The electrochemical converter power system of claim 1, further comprising a reactant processor disposed inside said pressure vessel and in fluid communication with said array of electrochemical converters.

3. The electrochemical converter power system of claim 1, further comprising a reactant processor disposed external to said pressure vessel and in fluid communication with said array of electrochemical converters.

4. The electrochemical converter power system of claim 1, wherein said electrochemical converter array comprises multiple fuel cell elements, each said fuel cell element including electrolyte plates interleaved with thermally conducting plates.

5. The electrochemical converter power system of claim 1, wherein said electrochemical converter array comprises a plurality of fuel cell elements, each said fuel cell element having a tubular configuration.

6. The electrochemical converter power system of claim 2, wherein said reactant processor comprises a plurality of reactant processor elements, each said reactant processor element including chemical processing plates interleaved with thermally conducting plates.

7. The electrochemical converter power system of claim 2, wherein said electrochemical converter array comprises a plurality of fuel cell elements in

the form of stacks including electrolyte plates interleaved with thermally conducting plates, and

wherein said reactant processor includes multiple reactant processor elements, said reactant processor elements in the form of stacks having chemical processing plates interleaved with thermally conducting plates.

8. The electrochemical converter power system of claim 7, wherein said reactant processor stacks are columnar and are interdigitally positioned among said fuel cell stacks.

9. The electrochemical converter power system of claim 7, wherein at least one of said reactant processor elements includes means for attaining a radial isothermal condition, and wherein at least one of said fuel cell elements include means for attaining a radial isothermal condition.

10. The electrochemical converter power system of claim 7, wherein at least one of said reactant processor elements includes reactant flow means for reaching an isothermal condition in an axial direction, and wherein at least one of said fuel cell elements include reactant flow means for reaching an isothermal condition in an axial direction.

11. The electrochemical converter power system of claim 7, wherein at least one of said fuel cell elements include means for attaining a radial isothermal condition and means for attaining an axial isothermal condition.

12. The electrochemical converter power system of claim 2, wherein said reactant processor elements are interdigitally positioned among said fuel cell elements.

13. The electrochemical converter power system of claim 2, wherein said reactant processor elements and said fuel cell elements are interdigitally arranged in a selected pattern to equalize the distribution of thermal energy among said elements in said pattern, said pattern being selected from the group consisting of a rectangular pattern, a hexagonal pattern, and an octagonal pattern.

14. The electrochemical converter power system of claim 2, wherein said pressure vessel includes a wall bounding the interior of said pressure vessel, and wherein said reactant processor elements include processor elements located proximate to the wall of said pressure vessel and elements located distal from the wall of said pressure vessel, and wherein said fuel cell elements include fuel cell elements disposed proximate to the wall and fuel cell elements located distal to the wall,

said fuel cell elements and said reactant processor elements located distal to the wall being operated independently of said reactant processor elements and said fuel cell elements located proximate to said wall, and

wherein said electrochemical converter power system includes means for operating said fuel cell elements proximate to said vessel wall and said reactant processor elements proximate to said vessel wall at about the same temperature as said fuel cell elements distal from said vessel wall and as said reactant processor elements distal from said vessel wall.

15. The electrochemical converter power system of claim 1, wherein said electrochemical converter includes at least one means selected from the group consisting of means for pre-heating the electrochemical converter, means for preheating an oxidizer input reactant, means for preheating a fuel input reactant, means for preheating a steam input reactant, reactant processor means for reforming at least one input reactant to produce a resultant, means for heating the electrochemical converter array for maintaining steady state operation of said array, means for cooling the electrochemical converter array for maintaining steady state operation of said array, and means for regulating the temperature of said electrochemical converter.

16. The electrochemical converter power system of claim 15, comprising temperature regulation elements for receiving input reactants including fuel and oxidizer reactants for combustively heating said electrochemical converter.

17. The electrochemical converter power system of claim 15, further comprising temperature regulation elements for receiving a non-combusting input reactant for cooling said electrochemical converter.

18. The electrochemical converter power system of claim 15, further comprising means for regulating the temperature of one of said electrochemical converters to maintain a required operation temperature of said electrochemical converter array.

19. The electrochemical converter power system of claim 2, wherein said reactant processor comprises fuel reforming means for receiving fuel and steam input reactants and forming hydrogen and carbon monoxide resultants from said reactants.

20. The electrochemical converter power system of claim 2, wherein said reactant processor includes fuel reforming means for receiving fuel and oxidizer input reactants and forming hydrogen and carbon monoxide resultants from said reactants.

21. The electrochemical converter power system of claim 2, wherein said reactant processor comprises fuel reforming means for receiving fuel, steam and carbon dioxide input reactants and forming hydrogen and carbon monoxide resultants from said reactants.

22. The electrochemical converter power system of claim 2, wherein said reactant processor includes fuel reforming means for receiving input reactants to form a resultant therefrom, said reactant processor including at least one reactant processor stack comprising chemical processor plates interleaved with thermally conducting plates, said reactant processor stack having an enclosure for controlling the flows of input reactants to said reactant processor stack and of resultants generated by said reactant processor stack.

23. The electrochemical converter power system of claim 4 wherein said fuel cell elements are adapted for receiving fuel and oxidizer reactants for reforming of said fuel reactant and for power generation within said fuel cell elements.

24. The electrochemical converter power system of claim 4 further comprising cooling elements adapted for receiving heat generated by said fuel cell elements.

25. The electrochemical converter power system of claim 4 wherein said fuel cell elements generate and release fuel cell exhaust gases to the interior of said pressure vessel.

26. The electrochemical converter power system of claim 25, further comprising means for collecting said fuel cell exhaust gases for further processing, said further processing selected from the group consisting of recycling said exhaust gases for reforming use and cogeneration of energy employing said exhaust gases.

27. The electrochemical converter power system of claim 4 further comprising

means for operating said fuel cell elements in a reverse electrolysis mode wherein said fuel cell elements consume electricity and produce fuel species and oxidation species,

heater elements for supplying heat to said fuel cell elements, and

said fuel cell elements including receiving means for receiving heat from said heater elements.

28. The electrochemical converter power system of claim 1, wherein said pressure vessel can withstand up to about 1,000 psi internal pressure.

29. The electrochemical converter power system of claim 1, wherein said pressure vessel is a cylindrical pressure vessel.

30. The electrochemical converter power system of claim 1, further including

a heat exchanging element disposed with said pressure vessel to exchange heat therewith, said heat exchanging element adapted for exchanging heat with said pressure vessel by flowing a heat exchanging fluid through said heat exchanger.

31. The electrochemical converter power system of claim 30 wherein said heat exchange fluid includes at least a first of said input reactants, said first

input reactant flowing through said heat exchanger prior to the introduction of said first reactant to said electrochemical converter.

32. The electrochemical converter power system of claim 30 wherein said pressure vessel is regeneratively cooled by said heat exchanging fluid, said heat exchanging fluid including an oxidizer input reactant, such that the temperature of an external wall of said pressure vessel is maintained below about 250°F.

33. The electrochemical converter power system of claim 30, wherein said heat exchanging element includes a heat exchanging jacket disposed about said pressure vessel and having a porous wall, and said positive pressure vessel is transpirationally cooled by said heat exchanging fluid comprising an oxidizing input reactant flowing through said porous wall.

34. The electrochemical converter power system of claim 30, wherein said pressure vessel is regeneratively cooled by convective water and steam flowing in said heat exchanging element.

35. The electrochemical converter power system of claim 30, wherein said heat exchanging fluid comprises an oxidizer input reactant and said heat exchanging fluid is drawn through said heat exchanging element by a compressor.

36. The electrochemical converter power system of claim 1, further comprising high temperature thermal insulation disposed adjacent the wall of said pressure vessel.

37. The electrochemical converter power system of claim 1, wherein said input reactants include a fuel, a reforming agent and an oxidizer.

38. The electrochemical converter power system of claim 1, further comprising means for regulating the flow of a fuel input reactant to said electrochemical converter array to produce a selected power output of said electrochemical converter.

39. The electrochemical converter power system of claim 1, further including means for regulating the flow of a fuel input reactant to said electrochemical converter to maintain a selected operating temperature of said electrochemical converter.

40. The electrochemical converter power system of claim 1, wherein said input reactants include a reforming agent and a fuel, said power system further comprising means for regulating the flow of said reforming agent to be proportional to the flow of said fuel input reactant.

41. The electrochemical converter power system of claim 40, wherein said reforming agent is oxygen.

42. The electrochemical converter power system of claim 40, wherein said reforming agent comprises fuel exhaust generated by said electrochemical converter array.

43. The electrochemical converter power system of claim 1, further comprising means for collecting exhaust produced by said electrochemical converter array at or near the operating temperature of said array and at or near the pressure of exhaust gases from said array.

44. The electrochemical power system of claim 1, further comprising a recuperator, and means for introducing exhaust gases produced by said electrochemical converter array to said recuperator for preheating said input reactants.

45. The electrochemical power system of claim 1, further including a heat exchanger, and means for introducing exhaust gases produce by said electrochemical converter array to said heat exchanger for the cogeneration of energy.

46. The electrochemical converter power system of claim 1, further comprising a steam boiler and means for introducing exhaust gases produced by said electrochemical converter array to said boiler for the generation of steam.

47. The electrochemical converter power system of claim 1, further comprising a gas turbine, and means for introducing exhaust gases generated by said electrochemical converter array to said gas turbine to generate power.

48. The electrochemical converter power system of claim 47, including a recuperator for preheating said input reactants with said exhaust gases generated by said electrochemical converter array.

49. An electrochemical converter system for use with a bottoming device, comprising

an electrochemical converter array adapted for receiving input reactants;

a positive pressure vessel disposed about said electrochemical converter assembly;

a heat exchanging element disposed relative to said pressure vessel for exchanging heat therewith, said heat exchanging element being in fluid communication with said fuel cell array for delivery of input reactants thereto; and

a blower in fluid communication with said heat exchanging element for circulating a heat transfer fluid comprising an input reactant through said heat exchanging element for transferring heat between said pressure vessel and said input reactant prior to delivery thereof to said electrochemical converter.

50. The electrochemical converter system of claim 49, wherein said blower draws said heat exchanging fluid through said heat exchanging element.

51. The electrochemical converter system of claim 49, wherein said blower blows said heat exchanging fluid through said heat exchanging element.

52. The electrochemical converter system of claim 49, wherein said electrochemical converter array includes a plurality of electrolyte plates alternately stacked with interconnection plates.

53. The electrochemical converter system of claim 49, wherein said electrochemical converter includes a fuel reformer for reforming an input reactant.

54. The electrochemical converter system of claim 49, wherein said heat exchanging element comprises a tubular coil disposed circumferentially about said pressure vessel.

55. The electrochemical converter system of claim 49, wherein said heat exchanging element comprises a jacket disposed about said pressure vessel.

56. The electrochemical converter system of claim 49, wherein the bottoming device is a heat actuated chiller.

57. The electrochemical converter system of claim 49, wherein the bottoming device is a thermal fluid boiler.

58. The electrochemical converter system of claim 49, wherein the bottoming device is a steam boiler.

59. The electrochemical converter system of claim 49, wherein the bottoming device is heating, ventilation, and air conditioning system that includes at least one of a thermal fluid boiler and heat actuated chiller.

60. An electrochemical converter power system, comprising

an electrochemical converter adapted for receiving input reactants,

a pressure vessel disposed about and in thermal communication with said converter, said electrochemical converter venting exhaust gases comprising spent input reactants to the interior of said pressure vessel,

a heat exchanging element disposed with said pressure vessel for exchanging heat therewith, said heat exchanging element adapted for exchanging heat at least with said pressure vessel by flowing a heat exchange fluid including a selected input reactant through said heat exchanger prior to introduction of said selected reactant to said electrochemical converter, and

cogeneration bottoming means arranged to receive heated exhaust gases generated by said electrochemical converter.

61. The electrochemical converter power system of claim 60, wherein said cogeneration bottoming means is chosen from the group consisting of a thermal fluid boiler, a steam boiler, a heat actuated chiller including a vapor generator, and a gas turbine.

62. The electrochemical converter power system of claim 60, wherein said electrochemical converter is a fuel cell selected from the group consisting of a solid oxide fuel cell, a molten carbonate fuel cell, a phosphoric acid fuel cell, an alkaline fuel cell, and a proton exchange membrane fuel cell.

63. The electrochemical converter power system of claim 60, wherein said system further includes exhaust means for collecting exhaust gases collected by said pressure vessel at a temperature near the operating temperature of said electrochemical converter and at a pressure near the pressure of spent reactants within said electrochemical converter, said exhaust means being in fluid communication with said cogeneration means for delivery thereto of said exhaust gases.

64. The electrochemical converter power system of claim 60, further comprising a recuperator for recuperating heat from said exhaust gases for preheating a first of said input reactants prior to introduction of said first input reactant to said electrochemical converter, said recuperator receiving said exhaust gases from said exhaust means and delivering said exhaust gases to said cogeneration bottoming means.

65. The electrochemical converter power system of claim 60, further including a drawing pump for drawing said heat exchanging fluid through said heat exchanging element and for delivery of said heat exchanging fluid to said electrochemical converter.

66. The electrochemical converter power system of claim 60, wherein said cogeneration means is a gas turbine, and the compressor section of said

turbine draws said heat exchanging fluid through said heat exchanging element and delivers said heat exchanging fluid to said electrochemical converter.

67. The electrochemical converter power system of claim 66, further comprising an electric generator coupled to said gas turbine.

68. The electrochemical converter power system of claim 66, further comprising a recuperator for preheating with exhaust gases generated by said gas turbine a first input reactant before introduction of said first input reactant to said electrochemical converter.

69. The electrochemical converter power system of claim 1 further comprising

a feedthrough for transferring a fluid from the interior of said pressure vessel to the exterior thereof, said feedthrough including

a body extending along a longitudinal axis from a first end for connection to the pressure vessel to a second end, said body further including

a first section having an outer pressure jacket disposed about an insulator having a bore therethrough,

a second section including an outer insulative jacket disposed about an inner pressure tube having an inner lumen, and

wherein said first and second sections are interconnected such that said bore and said inner lumen are in fluid communication for transferring a fluid from the first end of the feedthrough to the second end thereof.

70. The electrochemical converter power system of claim 49 further comprising

a feedthrough for transferring a fluid from the interior of said pressure vessel to the exterior thereof, said feedthrough including

a body extending along a longitudinal axis from a first end for connection to the pressure vessel to a second end, said body further including

a first section having an outer pressure jacket disposed about an insulator having a bore therethrough,

a second section including an outer insulative jacket disposed about an inner pressure tube having an inner lumen, and

wherein said first and second sections are interconnected such that said bore and said inner lumen are in fluid communication for transferring a fluid from the first end of the feedthrough to the second end thereof.

71. The electrochemical converter power system of claim 60 further comprising

a feedthrough for transferring a fluid from the interior of said pressure vessel to the exterior thereof, said feedthrough including

a body extending along a longitudinal axis from a first end for connection to the pressure vessel to a second end, said body further including

a first section having an outer pressure jacket disposed about an insulator having a bore therethrough,

a second section including an outer insulative jacket disposed about an inner pressure tube having an inner lumen, and

wherein said first and second sections are interconnected such that said bore and said inner lumen are in fluid communication for transferring a fluid from the first end of the feedthrough to the second end thereof.

72. The electrochemical converter power system of claim 69 wherein said feedthrough further comprises a pressure disc disposed between said first section and said second sections and joined to said pressure jacket and to said pressure tube to form pressure tight seals therewith.

73. A feedthrough for use with a pressure vessel, comprising

a body extending from a first end to a second end along a longitudinal axis and including

a first section having an outer pressure jacket disposed about an insulator having a bore therethrough,

a second section including an outer insulative jacket disposed about an inner pressure tube having an inner lumen, and

wherein said bore and said inner lumen are in fluid communication for transferring a fluid from a first end of the feedthrough to the second end thereof.

74. The feedthrough of claim 73 further comprising a pressure disc disposed between said first and second sections and joined to said pressure jacket and to said pressure tube to form pressure tight seals therewith.

75. The electrochemical converter power system of claim 5 wherein said fuel cell elements are adapted for receiving fuel and oxidizer reactants for reforming of said fuel reactant and for power generation within said fuel cell elements.

76. The electrochemical converter power system of claim 5 further comprising cooling elements adapted for receiving heat generated by said fuel cell elements.

77. The electrochemical converter power system of claim 5 wherein said fuel cell elements generate and release fuel cell exhaust gases to the interior of said pressure vessel.

78. The electrochemical converter power system of claim 5 further comprising

means for operating said fuel cell elements in a reverse electrolysis mode wherein said fuel cell elements consume electricity and produce fuel species and oxidation species,

heater elements for supplying heat to said fuel cell elements, and

said fuel cell elements including receiving means for receiving heat from said heater elements.